Wide-field Infrared Survey Explorer

First Results from the WISE IR Excesses around Degenerates (WIRED) Survey

J. H. Debes[1,2], D. W. Hoard[3], S. Wachter[4], D. T. Leisawitz[1], M. Cohen[5], M. Kilic[6,7],J.D. Kirkpatrick[4], R. L. Griffith[4]

[1]NASA Goddard Space Flight Center, [2]NASA Postdoctoral Program Fellow, [3]Spitzer Science Center, Caltech, [4]IPAC, Caltech, [5]Monterey Institute for Research in Astronomy, [6]Smithsonian Astrophysical Observatory, [7]Spitzer Fellow

Abstract

The WISE IR Excesses around Degenerates (WIRED) Survey is designed to find low mass companions and dusty disks around white dwarfs using data from NASA's Wide-field Infrared Survey Explorer (WISE) mission. WISE has finished scanning the entire sky, and we have currently cross-correlated the SDSS DR7 white dwarf catalogue with 2MASS, UKIDSS, and WISE photometry to identify candidate excess sources. An overview of the WIRED survey is given in a companion presentation at this AAS meeting ("The WIRED Survey" by Hoard et al., 333.09). We show the expected sensitivity level of the WIRED Survey to white dwarfs with dust and/or low mass companions, and present new candidate WISE detections.

WIRED Sensitivity

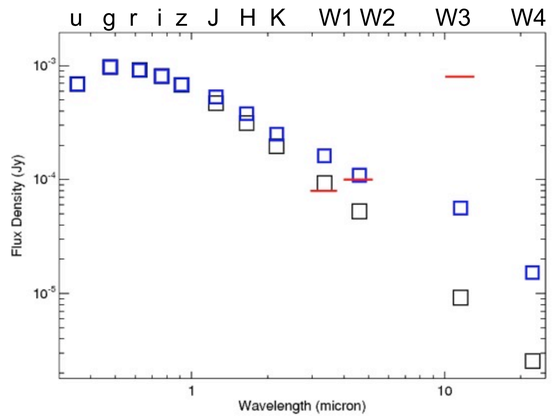

Fig. 1 A 10000 K WD model (black squares) at 70 pc and a WD+T2 model (blue squares) compared to nominal WISE sensitivity limits (red lines).

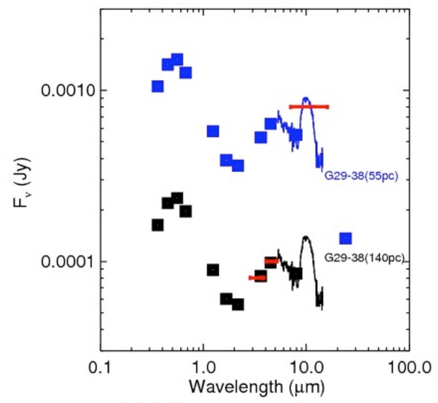

Fig. 2 Analogues to G29-38 (black and blue data), a bright WD disk at different distances compared to the sensitivity limits of W1, W2, and W3 (red lines).

Companion Sensitivity

- WIRED will detect T2 and earlier spectral types to **> 70 pc**
- Mid-IR photometry for hundreds of WD+M systems
- **Place strong limits on substellar companions to WDs**

Disk Sensitivity

- WIRED will detect G29-38 analogues out to **140 pc** in W1 (3.3 μm) and W2 (4.6 μm)
- Silicate features will be detected in W3 (12 μm) to **55 pc**
- **We expect ~30 WD disks to be detected in DR7**

Previously Detected Dusty White Dwarfs

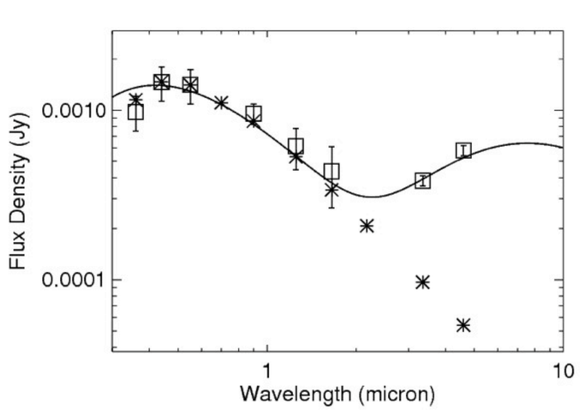

Fig. 3 SED of WD 1116+121, a WD disk with previously published IRS and IRTF spectra, but with no published Mid-IR photometry at 3 and 4 μm. This WD is detected with WISE and allows a more precise estimate of the radius of the inner edge of the disk. Black squares are the photometry, black asterisks are a model WD photosphere, the black line is a WD+disk model with R_{in}=12 R_{WD}.

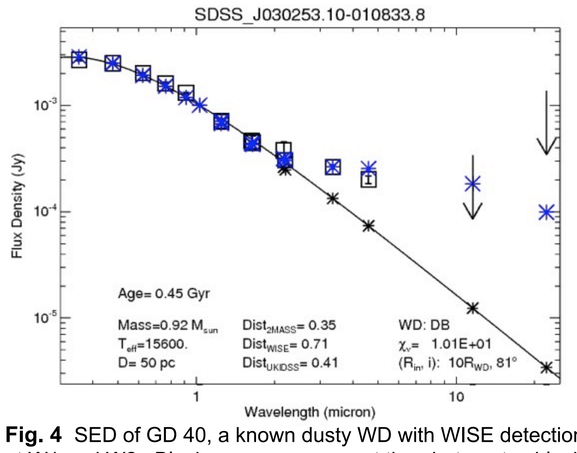

Fig. 4 SED of GD 40, a known dusty WD with WISE detections at W1 and W2. Black squares represent the photometry, black asterisks are a model WD photosphere, and the blue asterisks are a WD+disk model with R_{in}=10 R_{WD} and i=81°. $Dist_x$ refers to astrometric differences in centroids. $Dist_x$ <2″ are consistent with uncertainties in proper motion and WISE astrometry. χ_ν is the reduced χ^2 for the model.

Selected Excess Candidates

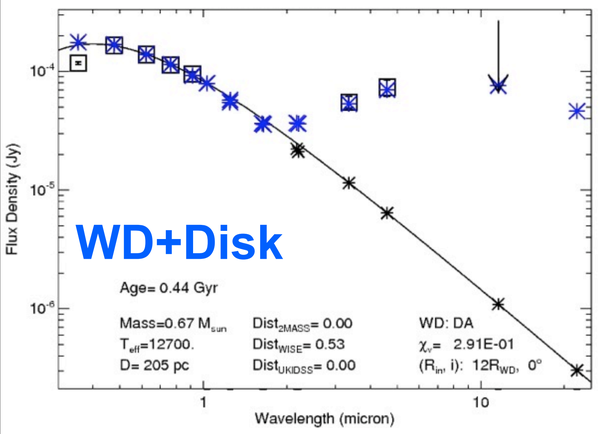

Fig. 5 SED of WIRED 1, a candidate WD+Disk excess. Symbols the same as in Figure 4. This WD has a photometric distance of 205 pc, demonstrating the nominal sensitivity of our survey.

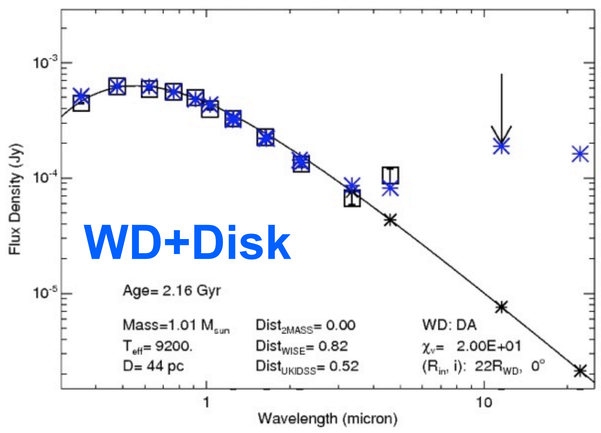

Fig. 6 SED of WIRED 2, a candidate WD+Disk excess. Symbols the same as in Figure 4. This WD has an unusually large inner radius and is older than typical disk systems.

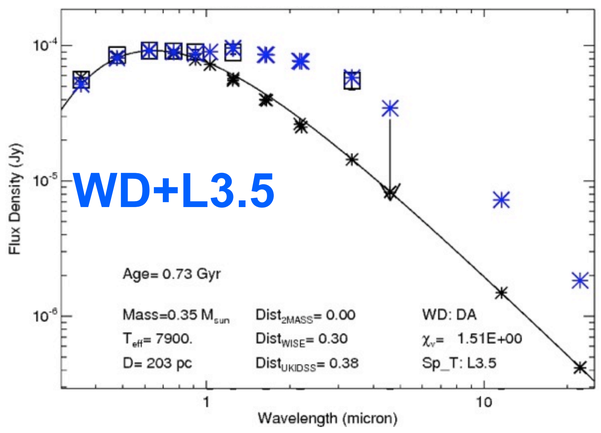

Fig. 7 SED of WIRED 3, a candidate WD+L3.5 system. Symbols the same as in Figure 4.

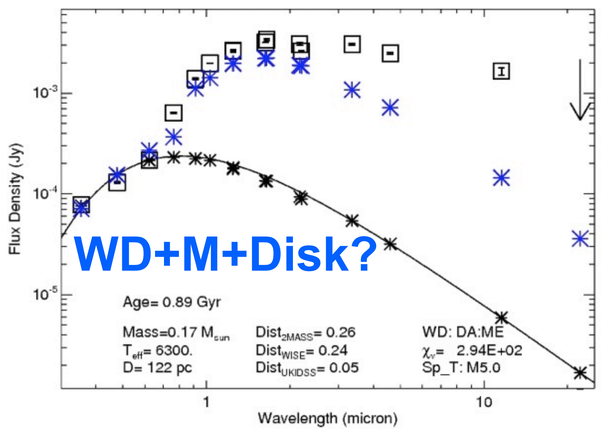

Fig. 8 SED of WIRED 4, a WD with an M dwarf companion in a very tight orbit. Symbols the same as in Figure 4. The W1, W2, and W3 detections suggest an excess in this post-common envelope binary system due to dust.

GALEX J193156.8+011745: A New DAZ with a WISE Excess

astro-ph/1012.4859

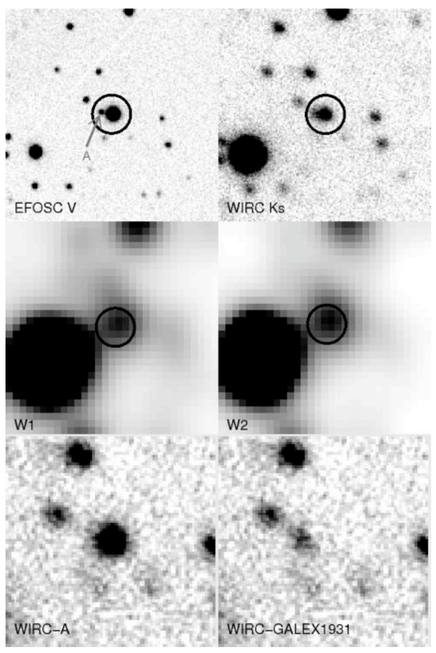

Fig. 9 Images of GALEX1931 (top left) at V with the EFOSC camera on the NTT (Vennes & Kawka 2010), (top right) at Ks with the WIRC camera on the Palomar 200", (middle left) W1, and (middle right) W2. GALEX1931's position is centered in the circle in each panel. Source A contaminates GALEX1931's H and K photometry, demonstrated in the bottom two panels where we subtract off both Source A and GALEX 1931. Source A's blue color means it does not impact the W1 and W2 photometry.

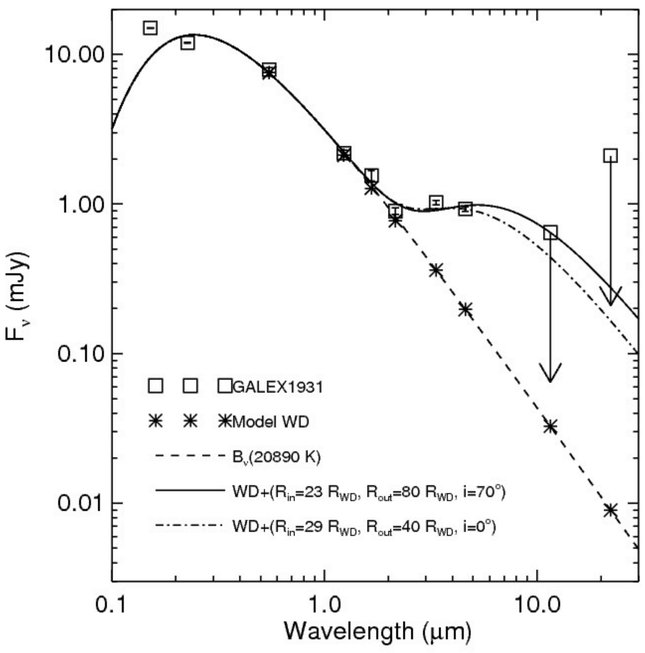

Fig. 10 Photometry of GALEX1931 and its excess compared to synthetic photometry of a similar WD using the models of (Bergeron et al., 1995), a black body with T_{eff}=20890 K and scaled to the V and J photometry of GALEX1931. Two different dusty disk models assuming a flat optically thick disk are overplotted.

Acknowledgements

This publication makes use of data products from the Wide-field Infrared Survey Explorer, which is a joint project of the University of California, Los Angeles, and the Jet Propulsion Laboratory/California Institute of Technology, funded by the National Aeronautics and Space Administration.

http://wise.astro.ucla.edu